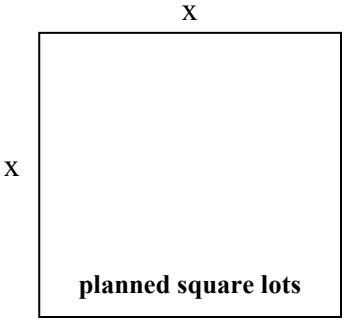
Investigation: A Lot of Changing Sides

A house developer wants to build a new housing development. She submits plans to the city planner for the new houses. The lots in the plans are all squares of the same size (as illustrated in the diagram). The city planner insists that the developer introduce some variety into the plan.



After some discussion, the planner and the developer decide that the lots should include other types of rectangles. So the developer changes the lengths of the sides of some of the lots.

All changes described in question 1 to 6 are comparisons to the original lot.

- *Make and label a sketch of the new lot. Use the variable x to represent the length of the side of the original square.*
- *Write an expression for the area of the new lot as the product of the length and width.*
- *Write an expression without parentheses for the area of the new lot as the sum of the smaller areas*.

1. The new lot is 3 m longer in the north-south direction. It is 4 m longer in the east-west direction.

2. The new lot is 5 m longer in the north-south direction. It is the same length in the east-west direction.

3. The new lot is 10 meters longer in the north-south direction. It is 9 m longer in the east-west direction.

4. The new lot is 1 meters longer in the north-south direction. It is 25 m longer in the east-west direction.

5. The new lot is 2 meters longer in the north-south direction. It is 3 m longer in the east-west direction.

6. The new lot is 3 meters shorter in the north-south direction. It is 4 m shorter in the east-west direction.

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Investigation: A Lot of Changing Sides (Teacher Notes)

NC CCSS Math 1: Seeing structure in expressions
A-SSE.1 Interpret expressions that represent a quantity in terms of its context.*
A-SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
NC CCSS Math 1: Arithmetic with Polynomials & Rational Expressions
A-APR.1 Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

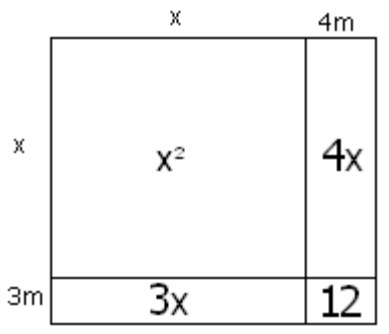
General notes:

The intent of this lesson is to introduce the area model for multiplying binomials.

When students write the expression for the area of the new lot as the product of the length and width, they should recognize the length of the rectangle as being an expression of the form (x±a) where a is some length longer or shorter. Same applies for the width.

When students write the expression for the area without parentheses, they should recognize the area of the entire rectangle as the sum of its parts. The key idea is to build an understanding of the area model as a representation of the distributive property of multiplication over addition. This connection should be made before utilizing the symbolic manipulation in later lessons.

1.

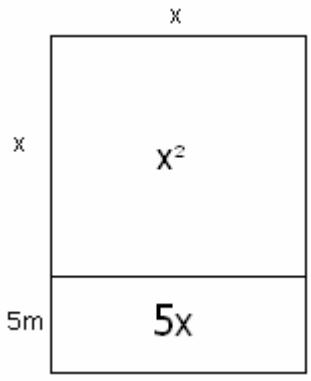


Area = (x + 4)(x + 3)

Area = $x^2 + 4x + 3x + 12$

$= x^2 + 7x + 12$

2.



Area = x (x + 5)

Area = $x^2 + 5x$

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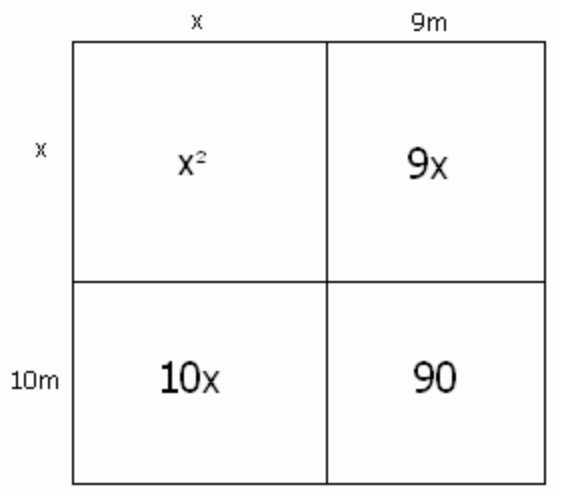
3.

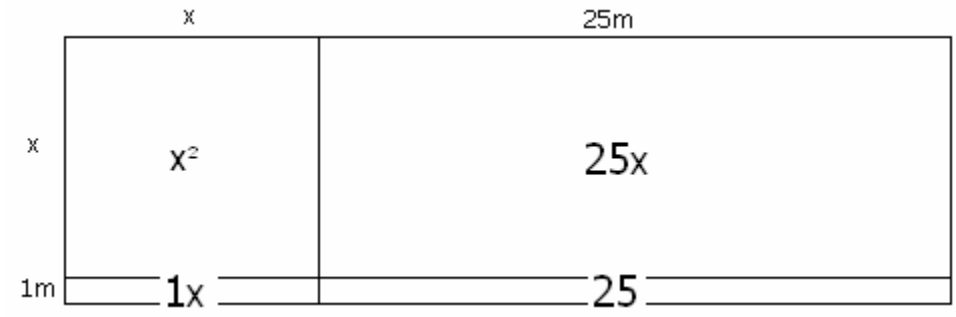


Area = (x + 9)(x + 10)

Area = x^2 + 9x + 10x + 90

= x^2 + 19x + 90

4.

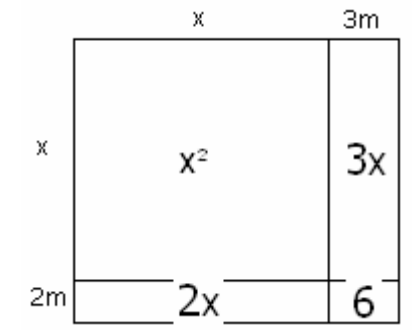


Area = (x + 25)(x + 1)

Area = x^2 + 25x +1x +25

= x^2 + 26x + 25

5.

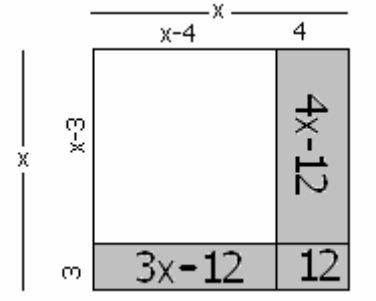


Area = (x + 3)(x + 2)

Area = x^2 + 3x + 2x + 6

= x^2 + 5x + 6

6. Three different models



Area = (x – 4) (x – 3)

Area = x^2 -(4x – 12) – (3x – 12) – 12

= x^2 -4x + 12 – 3x + 12 – 12

= x^2 - 7x + 12

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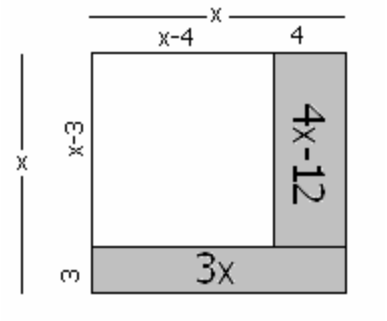
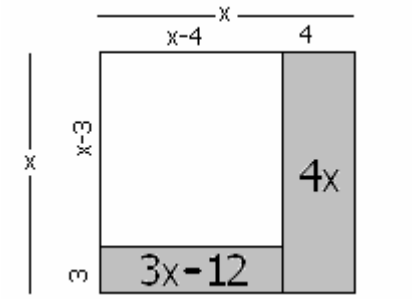


Area = (x – 4)(x – 3)

Area = x^2 - (4x – 12) – 3x

= x^2 - 4x + 12 – 3x

= x^2 - 7x + 12



Area = (x – 4)(x – 3)

Area = x^2 - 4x – (3x – 12)

= x^2 - 4x – 3x + 12

= x^2 - 7x + 12

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